Ground Heat Exchanger Design

with Modular Reversible Chillers

Moderator: Amanda Schneck / *WaterFurnace International*

Panel: Chris Johnson / *Trane Technologies*

Tim Hammond / *Climate Control Group*

Dan Arnold / *JR Swanson*

Daniel Cowan / *Fynite AE*

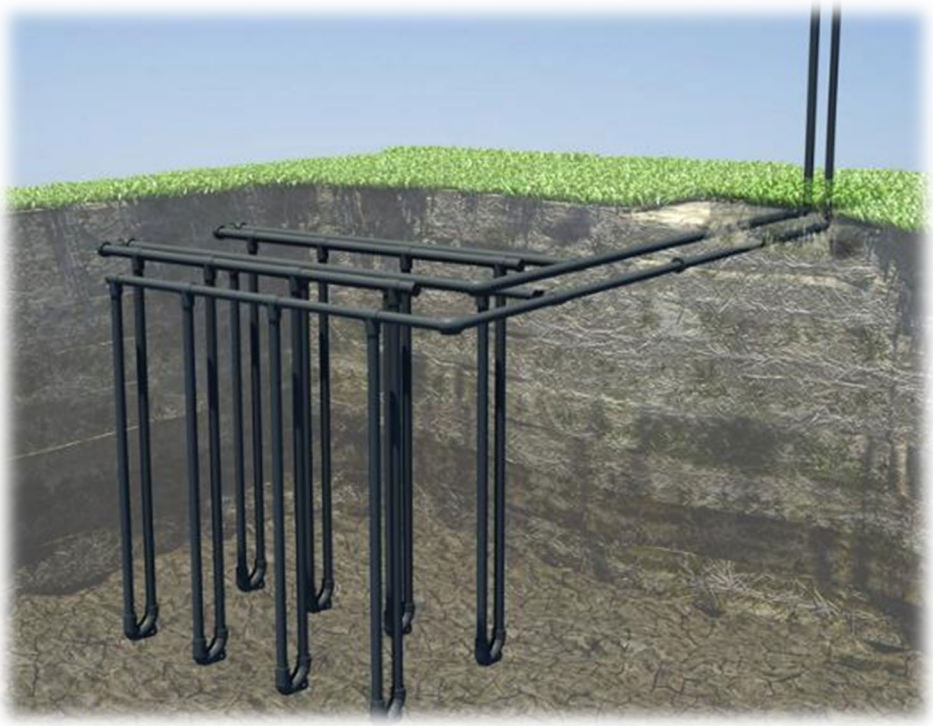
Modular 6-Pipe Systems and Ground Loop Design

Chris Johnson

Chris Johnson | Trane Technologies

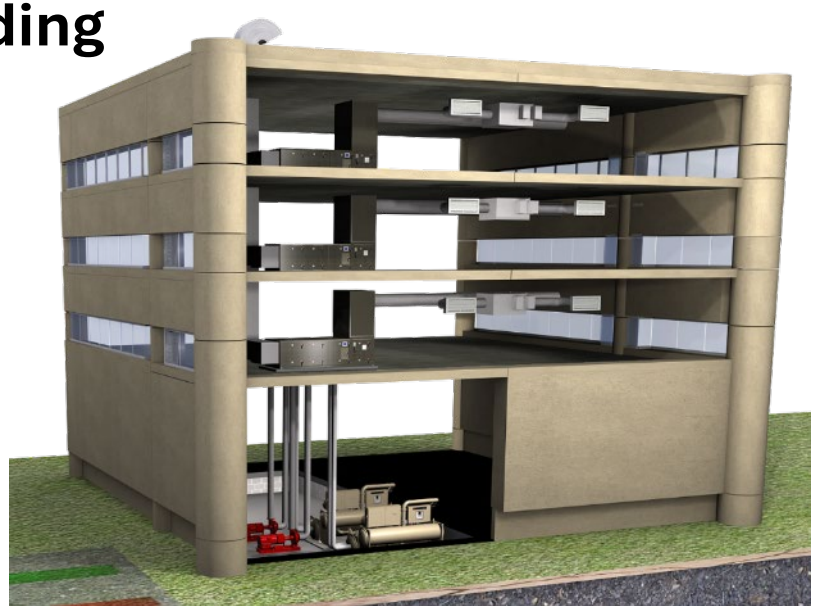
- Sales Engineer / Account Manager
- 15 years in renewable & alternative energy
  - Spread across hydrogen and power generation
- M.B.A. from the Simon School at University of Rochester
- B.S. in Mechanical Engineering from Rensselaer Polytechnic Institute

Overview of Geothermal Operation



Cooling the Earth

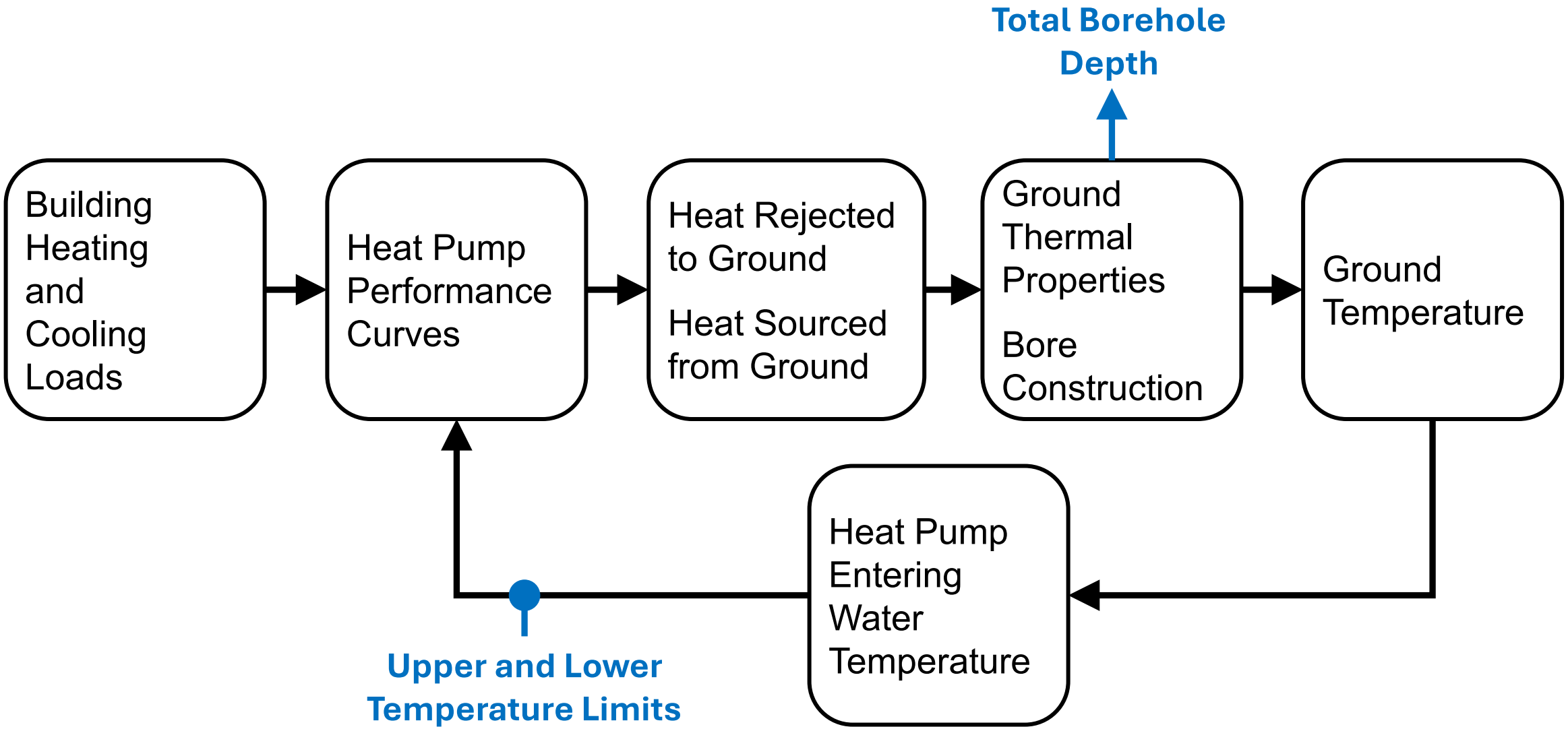
Heating the Building



Heating the Earth

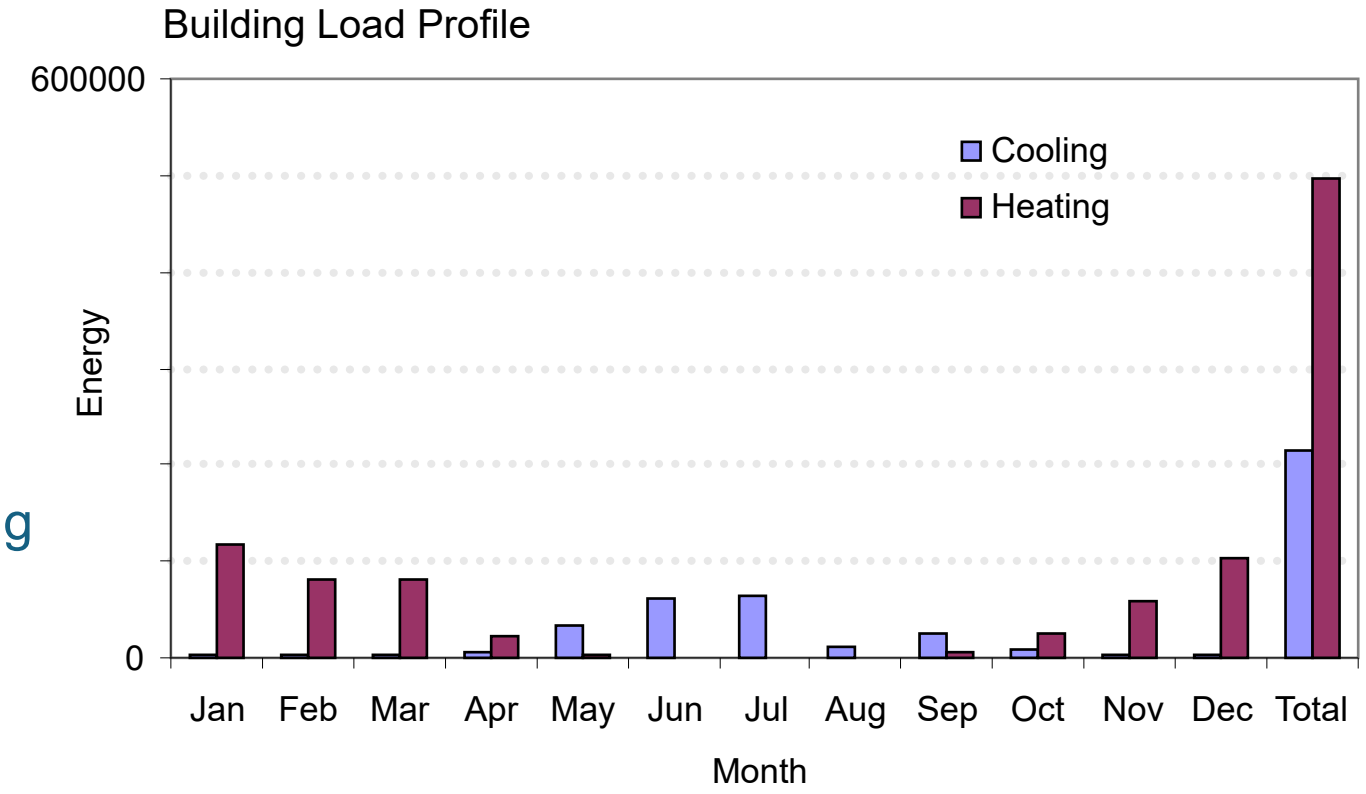
Cooling the Building

• Process for Sizing the Ground Heat Exchanger



Know Your System

- Don’t freeze the well short/medium/long term
  - Peak Output & Well recovery time
  - Field Recovery time
  - Life of the system & thermal drift
- Understand the system on site
  - Airside economizing
  - Waterside economizing
  - Future changes in occupancy or usage
- 8760 Modeling with scenario-based planning
  - Understand the base case for loads and wells
  - Evaluate extreme conditions
  - Evaluate alternative system configurations



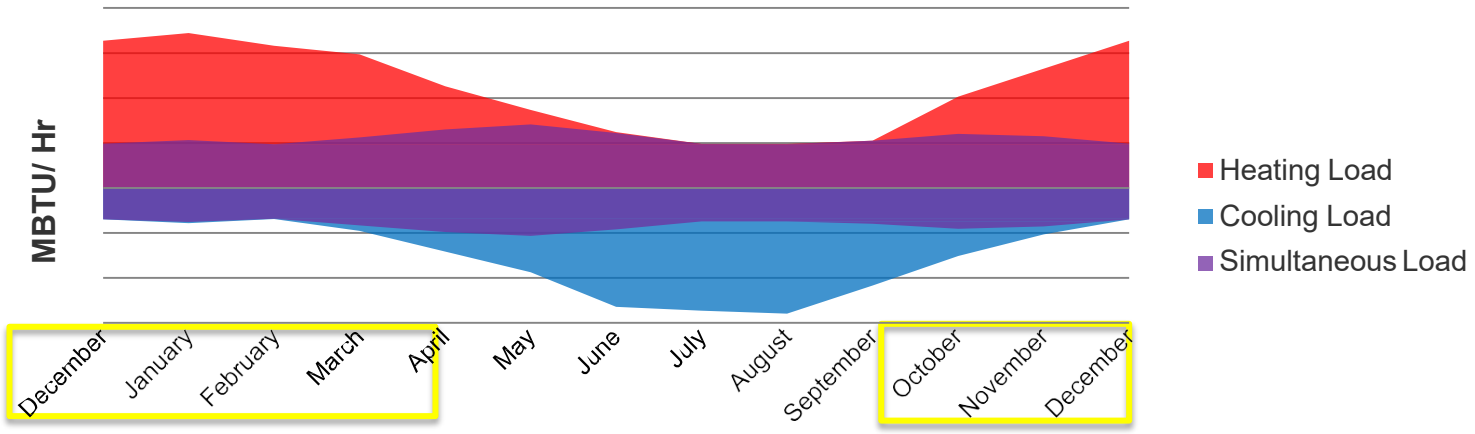
Tim Hammond

VP of Engineering & Product Management

Climate Control Group

- BS in Mechanical Engineering
  Purdue University
- +20 years in geothermal/water-source heat pump & modular chiller equipment design
- Licensed Mechanical journeyman & IGSHPA certified

Simultaneous Heat Recovery vs Heat Pump



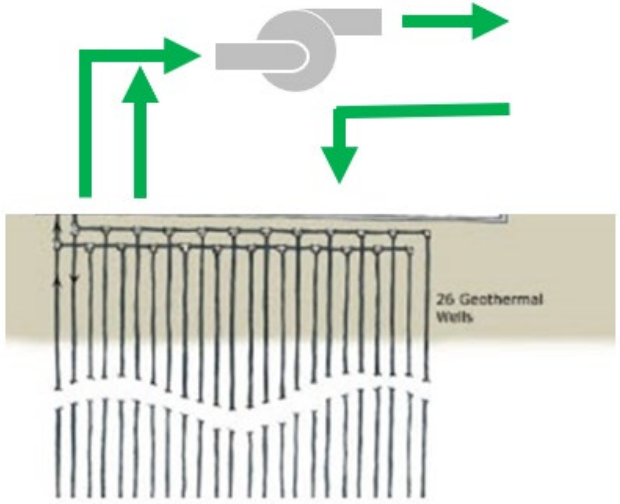
Heat Recovery System

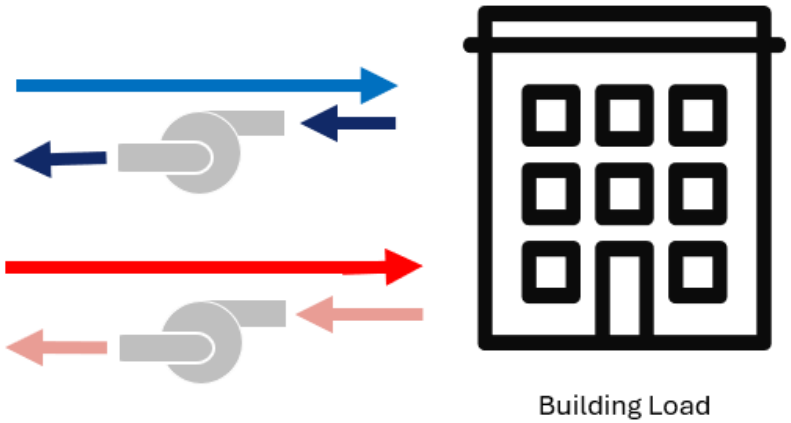
- Base simultaneous heating and cooling loads or thermal storage
- Independent module modes of operation: Heat recovery, Heat or Cool
- Source, Heating, or Cooling loops mix over time during mode change

Heat Pump System

- No or low simultaneous heating and cooling loads
- Independent module modes of operation: Heat or Cool
- Source loop is isolated and does not mix with Heating or Cooling loop. Some mixing of Heating and Cooling loops occur during mode change.

Single Plant Solution



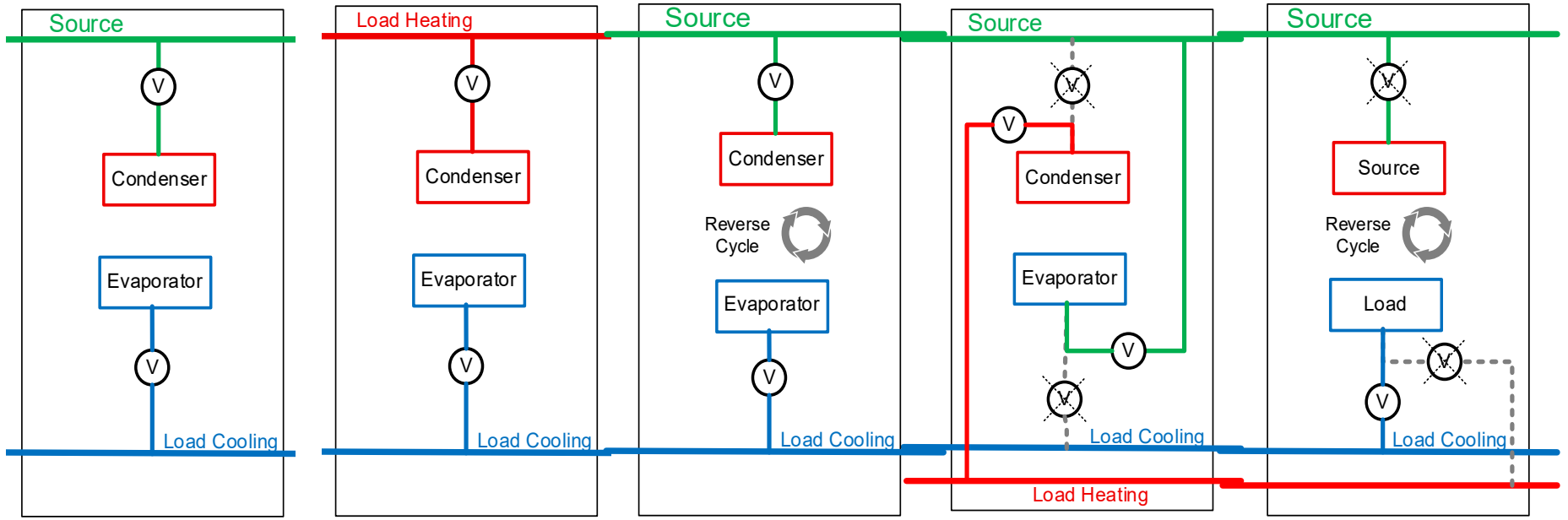


Modular Chiller Benefits

- Single equipment integration for heating and cooling
- All-electric solution
- High efficiencies with simultaneous heat recovery
- Redundancy built-in with N+1
- Flexible to match either any load combination

CLIMA COOL®

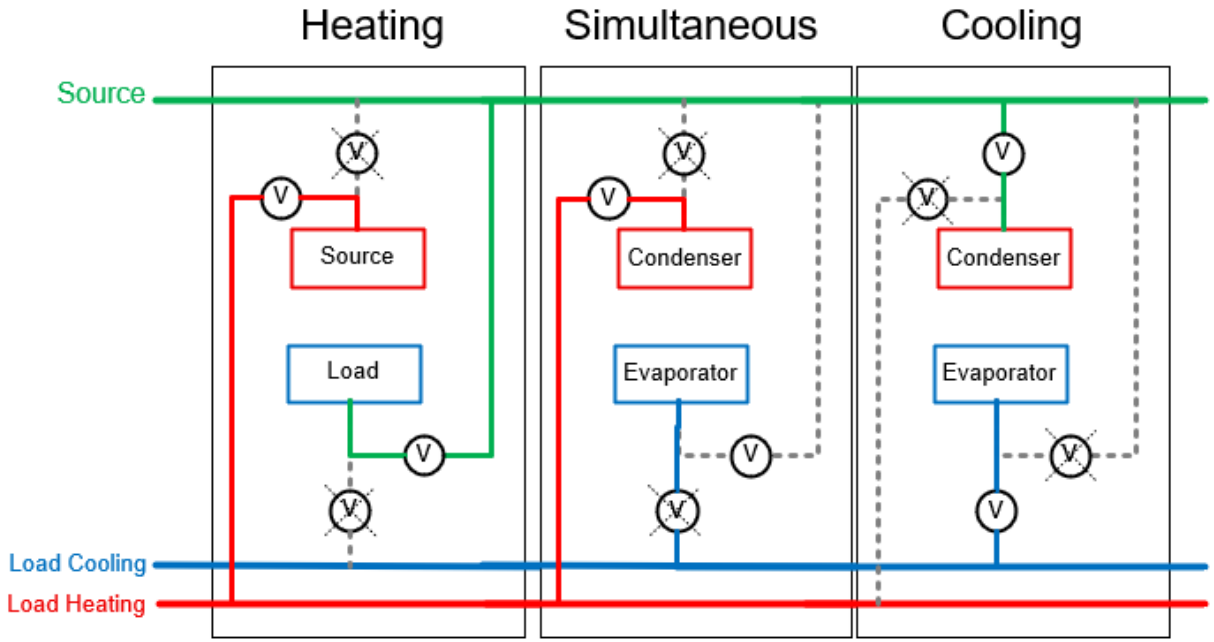
Types of Modular Equipment: Water-to-Water



	Water-Cooled Chiller	Heat Recovery Chiller	Water-Source Heat Pump	Simultaneous Heat Recovery Chiller	Water-Cooled Heat Pump
Configuration	4-Pipe	4-Pipe	4-Pipe	6-Pipe	6-Pipe
Modes	Cooling Only	Heat Recovery	Heating / Cooling	Heating / Cooling / Simultaneous	Heating / Cooling
Heat Pump	No	No	Yes	No	Yes
Heat Recovery	No	Yes	No	Yes	No
Ground Loop Suitable	Not traditionally	No	Yes	Yes, common fluid on all loops	Yes, typically on dedicated loop

6-Pipe Simultaneous Modular Chillers

- Designed to banked together
- Up to 12 modules controlled as one system
- Each unit is removable in the bank
- Up to 600 tons in a bank
- Operating Guidelines
  - Hot water production
    - 70 – 140 deg F
  - Chilled water production
    - 15 – 65 deg F

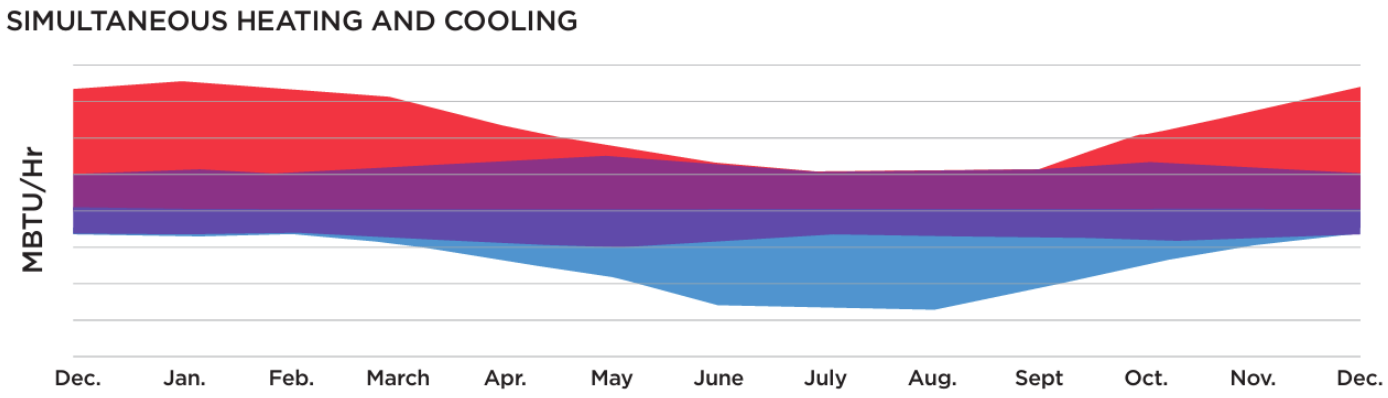


Dan Arnold - JW Swanson & Associates

- Engineering based HVAC sales Organization
- Buffalo / Rochester / Syracuse / Utica
- Relationship driven business model
- BS in Mechanical Engineering and MBA at University of Buffalo
- Licensed P.E. in NYS
- CGD

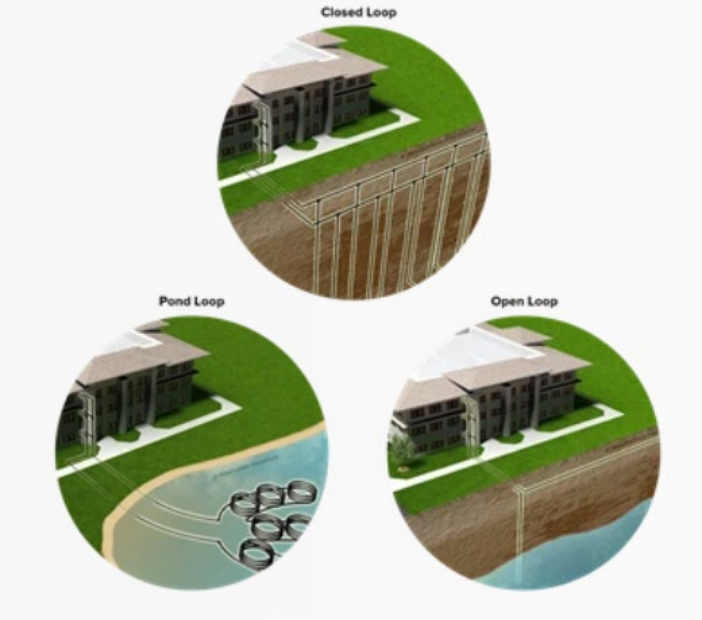
Modular Heat Pump Chillers – Application Considerations

- System Operation (2-Pipe, 4-Pipe, Htg Only, etc)
  - Simultaneous Heating & Cooling
- Pumping Configuration
  - Variable Primary vs Primary Secondary
- System Volume
- Design Criteria
  - Loop Temperatures
    - **Impact on GHX**
  - Delta T's

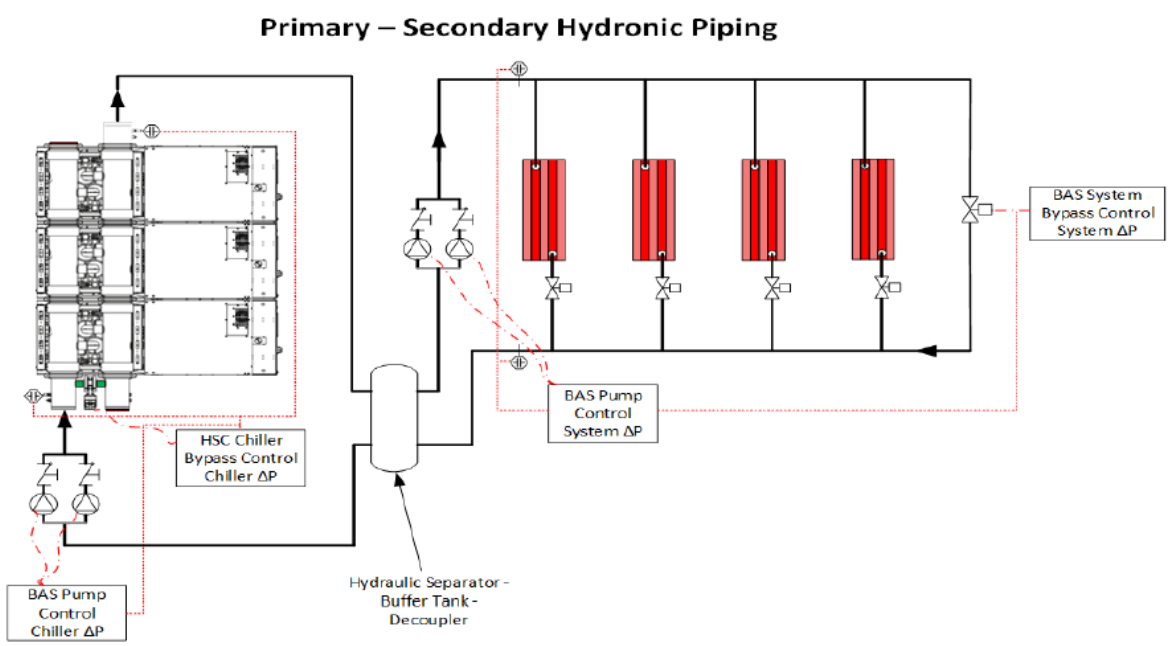


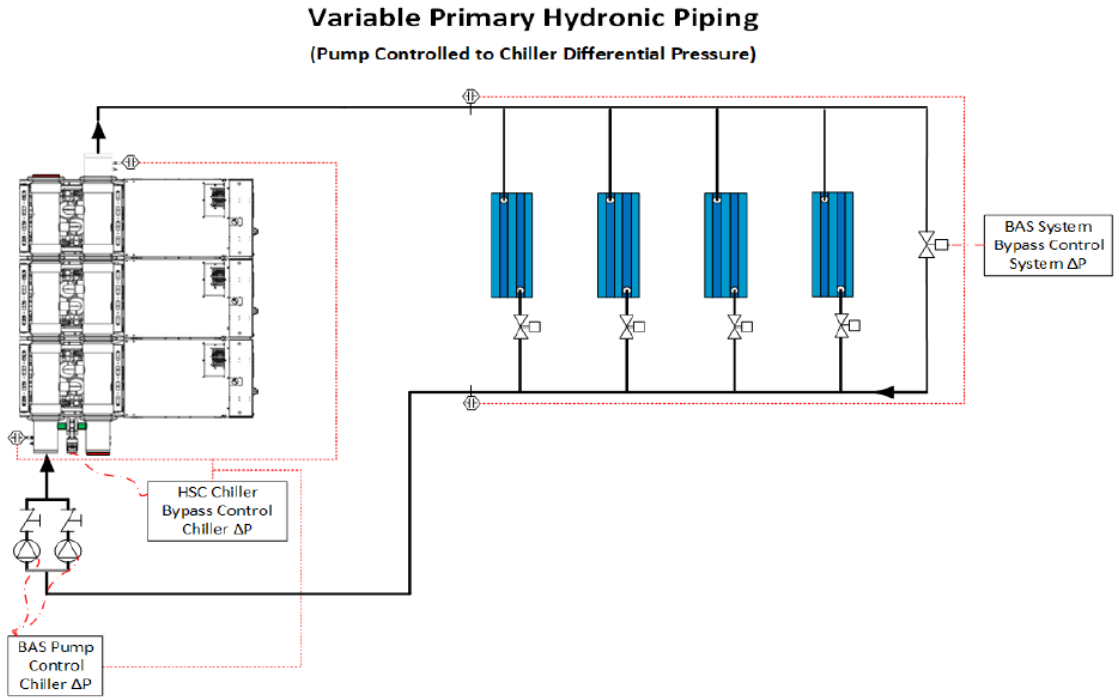
Modular Heat Pump Chillers – Retrofit Considerations

- Retrofitting a building that had a steam or HW boiler
  - Design loop temps
    - Possible that building was designed for 180F. Will a lower temperature work?
    - Old HW systems typically oversized, verification needed.
  - Piping arrangement
    - These aren't 40 deg delta T boilers!
  - Space inside building
  - Cooling being added?
    - **Impact on GHX Design**



Modular Heat Pump Chillers – Pumping Considerations





OPERATIONAL CONSIDERATIONS

Presented By: Daniel A. Cowan P.E.
Chief Engineering Officer, Fynite AE Inc.
Date: March 2026

FYNITE INTRODUCTION

4 Years
A-GANG

11 Years
Service and Construction

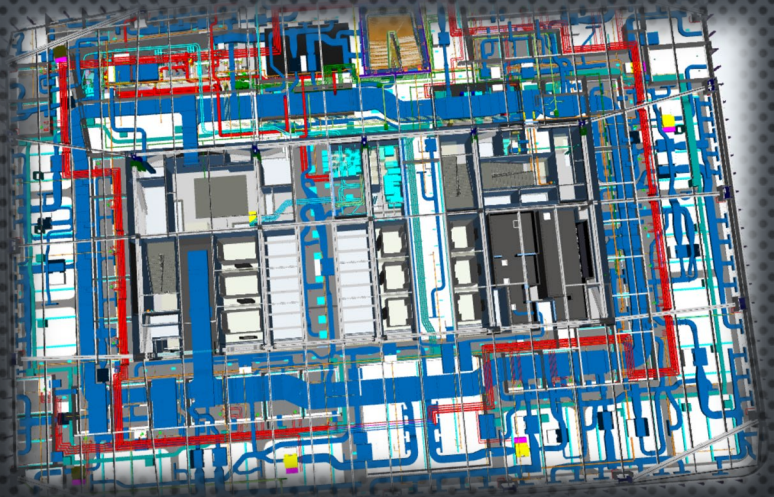
Design Build Contracting

8 Years

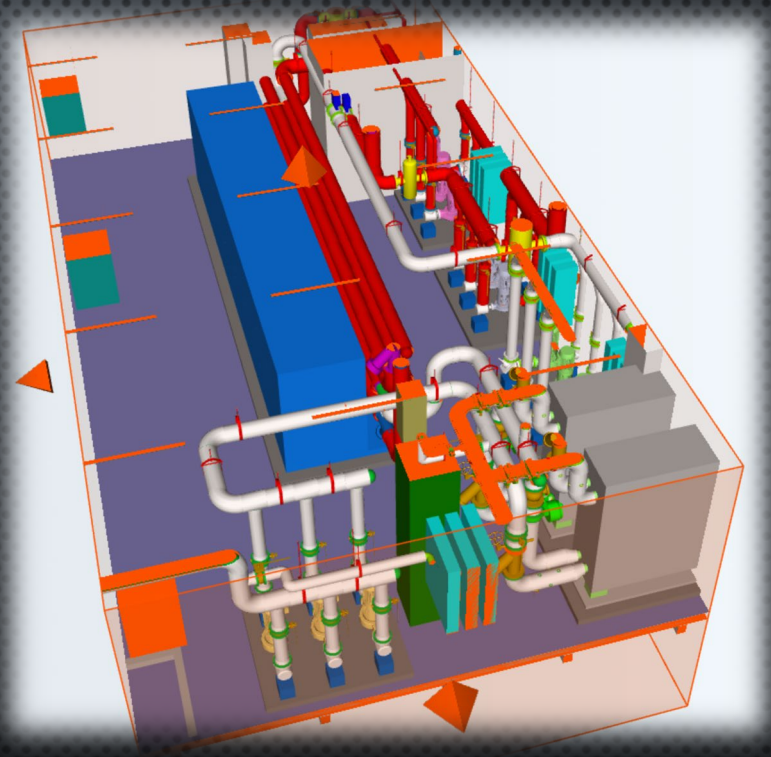
4 Years

ORTHODOX CHURCH in AMERICA

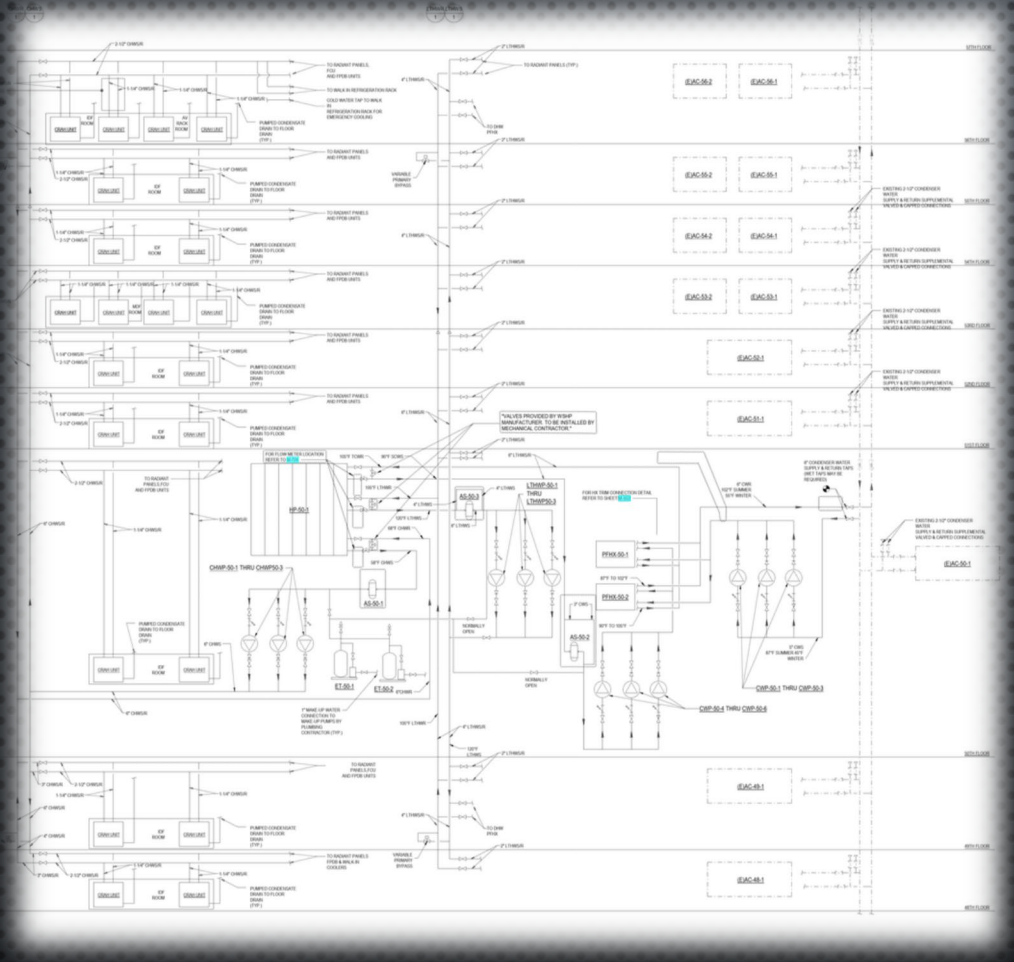
REAL WORLD EXAMPLE



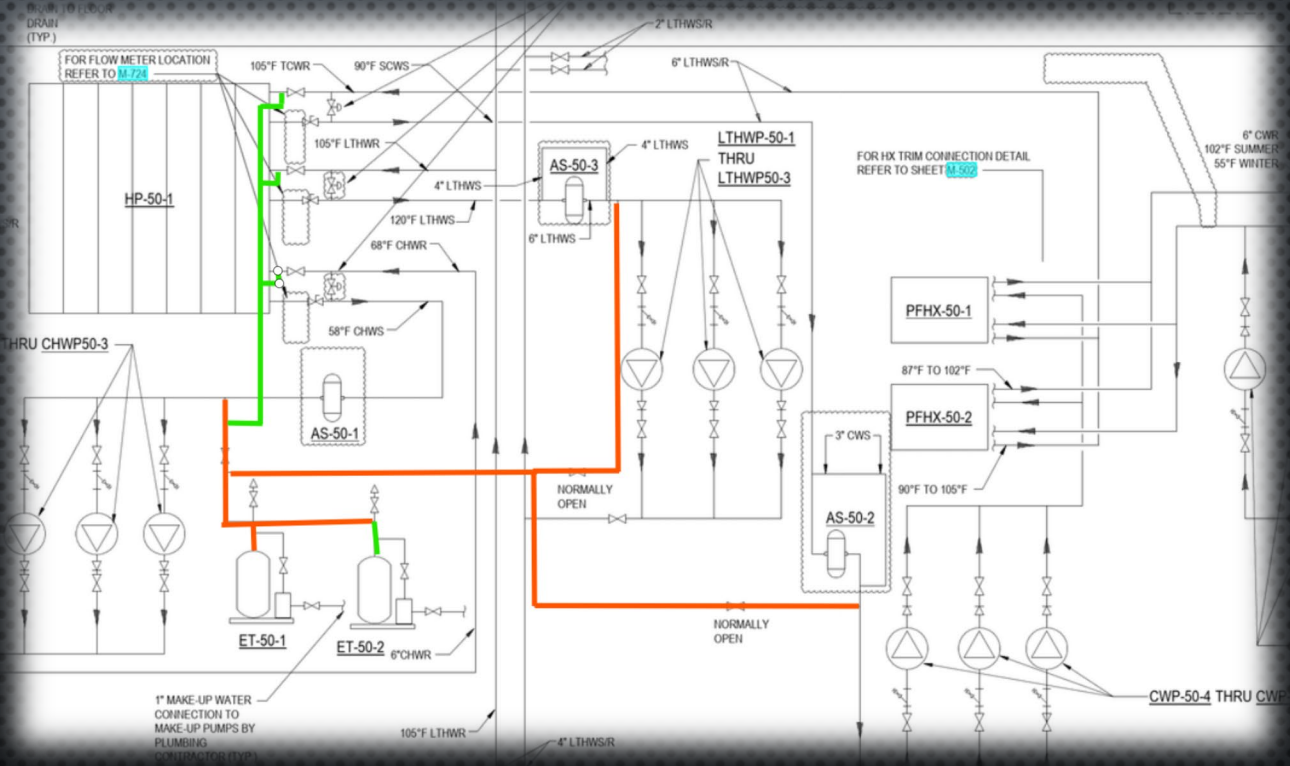
Financial Organization
Locally Hosted Servers
Precise Comfort
Radiant Panels
Sensible Coils
VAV from Base Building
10 of 60 Floors
Cooling Tower



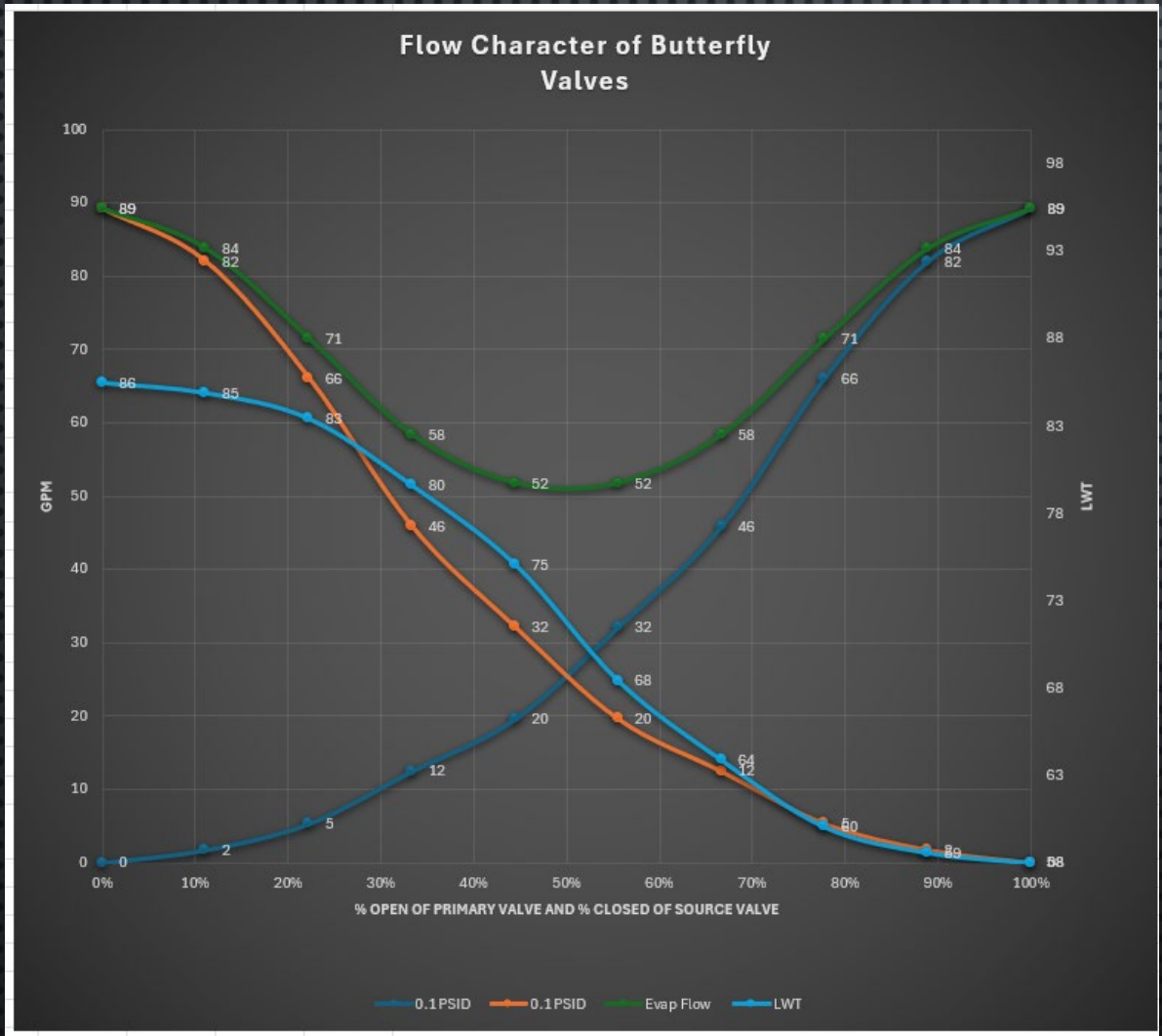
MANUFACTURE REQUIREMENTS AND INTERPRETATION

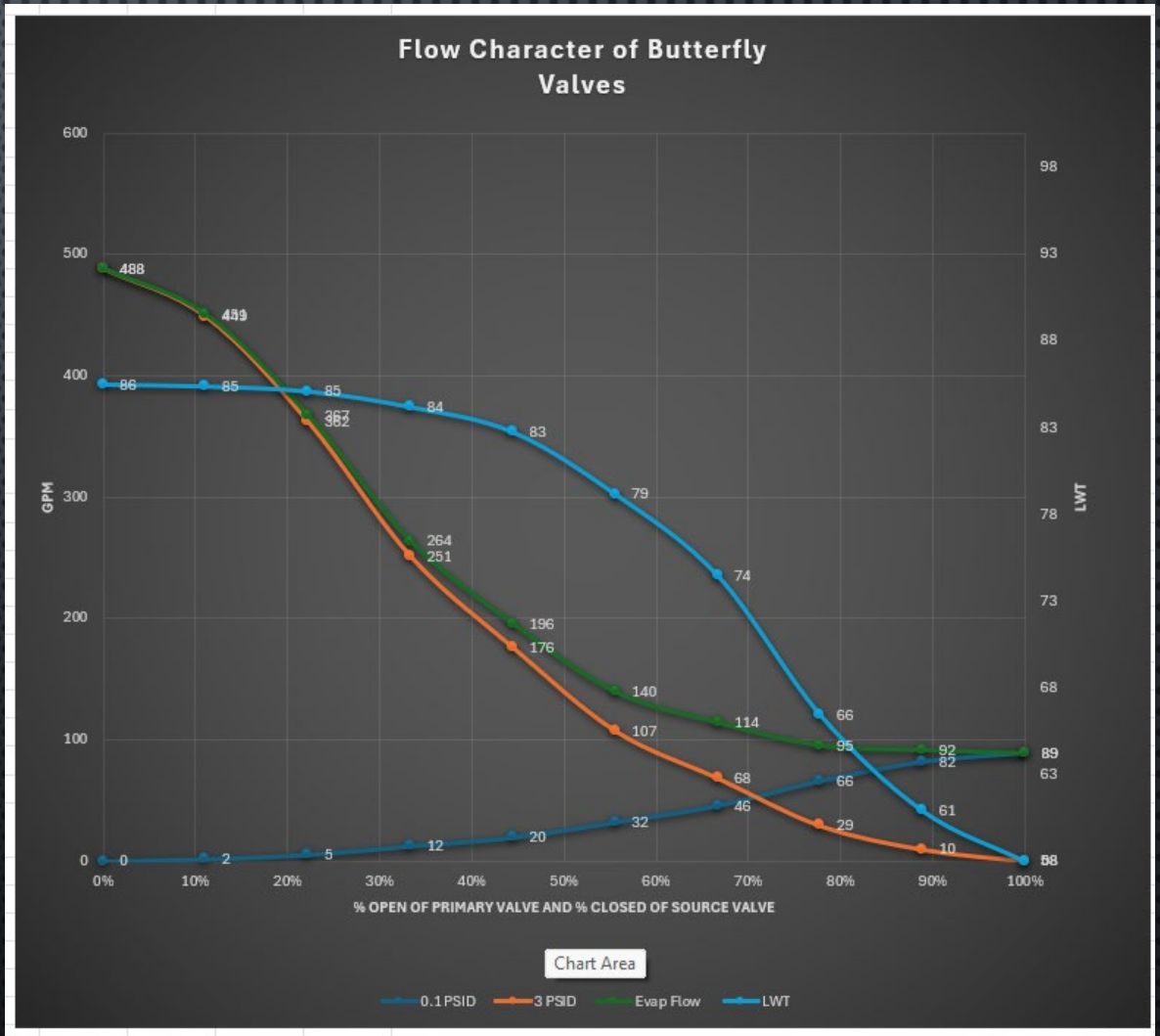


All Systems must be at the same pressure level.

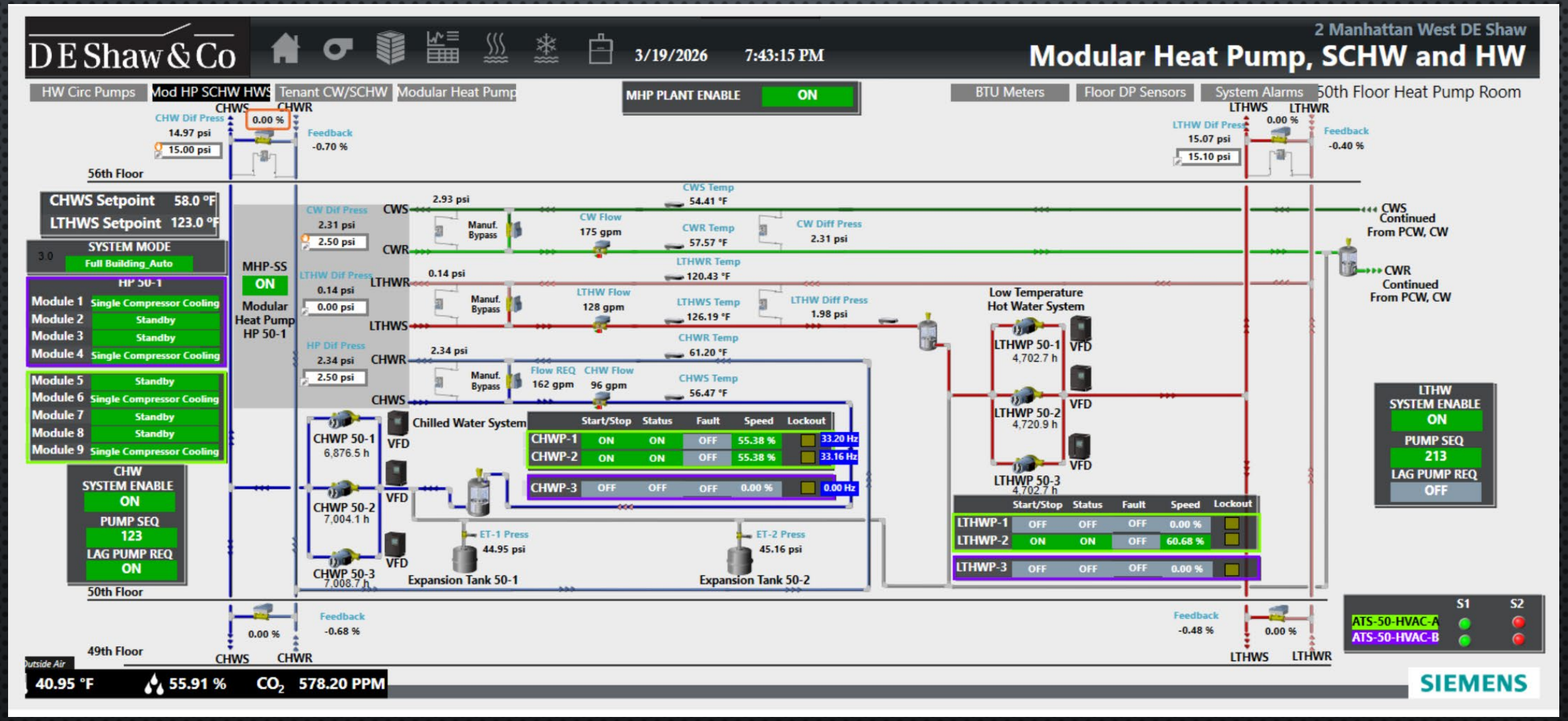


PRESSURE DEPENDENT VALVE OPERATION





LEADING CONTROL VS LAGGING CONTROL



THANK YOU

FyniteAE@pm.me

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